

REMARKS

Claims 1-3, 5-9, 11-15, 17 and 18 are currently pending in this application. This Amendment cancels claim 8 and amends claims 1, 7, 13 and 15. Support for the amendments to the claims can be found in the specification, drawings and claims as originally filed. No new matter has been added.

The Examiner did not acknowledge a claim of priority to the provisional application in this Office Action. Applicant respectfully requests that the Examiner acknowledge our claim of priority to United States Provisional Application No. 60/397,629 filed July 22, 2002, as indicated on page 1, paragraph [0001] of the present application and in Paragraph 5 of the filed Declaration and Power of Attorney.

35 U.S.C. § 103 Rejections

The Examiner has rejected claims 1-3, 5, 7, 9, 11 and 12 under 35 U.S.C. §103(a) for obviousness over Japanese Patent 61-235560 to Masaki et al. (hereinafter "the Masaki patent") in view of U.S. Patent No. 5,736, 019 to Bernick and U.S. Patent No. 4,631,106 to Nakazato et al. (hereinafter "the Nakazato patent"). Claims 1-3, 5-7, 9 and 11-13 stand rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 4,872,964 to Suzuki et al. (hereinafter "the Suzuki patent") in view of the Bernick patent, the Masaki patent and the Nakazato patent. Claims 8, 14, 15, 17 and 18 stand rejected under 35 U.S.C. §103(a) for obviousness over the Suzuki patent in view of the Bernick patent, the Masaki patent, the Nakazato patent and further in view of Japanese Patent No. 03-140467 to Ogawa (newly cited reference) and Japanese Patent No. 61-041194 to Fukami et al. (hereinafter "the Fukami patent"). see pages 2-9 of the Office Action. In response, independent claims 1, 13 and 15 have been amended to limit the movement of the magnet arrangement to rotational movement about an axis via the rotary drive unit. Support for the amendments to the claims can be found, for example, in canceled claim 8 and in paragraph [0029] on pages 6-7 of the present specification as originally filed.

The present invention, as claimed in independent claim 1, is directed to a magnetron sputtering electrode for use with a magnetron sputtering device. The magnetron sputtering electrode includes a cathode body, a rotary drive unit coupled to the cathode body, a target received by the cathode body and a closed magnet arrangement received within a magnet receiving chamber and coupled to the drive unit. The closed magnet arrangement is comprised of a plurality of magnets adapted for motion relative to the target by the drive unit,

wherein at least one of the plurality of magnets is a profiled magnet having a contoured top portion. The electrode further includes a support plate coupled to the rotary drive unit, wherein the support plate includes one or more spacer blocks situated on the support plate, wherein the spacer blocks are constructed of non-magnetic material. The plurality of magnets are arranged on the support plate such that a portion of the contoured top portion of each of the plurality of magnets is positioned beneath an upper surface of the spacer blocks, and wherein the rotary drive unit rotates the magnet arrangement, whereby the motion further comprises two or more rotational degrees of freedom of movement about an axis.

The electrode of the present invention uses profile magnets to optimize the shape of the magnetic field thereby activating more of the target area as shown in Exhibit A. The broader erosion profile of the target using the profile magnets results in about a 20% increase in target utilization in contrast to conventional magnets. This result increases throughput, efficiency, and produces longer run times in the magnetron electrode of the present invention. As shown in Exhibit B, the two or more rotational degrees of movement of the magnet arrangement about an axis (i.e., concentric and eccentric) with respect to the target results in a broad erosion profile both at the straight-aways S and at the ends (referred to as “turnarounds”) of the target. A magnet arrangement that has only rotational movement and linear movement will only produce a broad erosion profile at the straight-aways S and not at the turnarounds as shown in the prior art target of Exhibit B. The turnarounds will still have a steep erosion profile because the linear movement will not change the position of the magnetic flux lines with respect to the ends of the target. Therefore, the life of the target is limited by the steep erosion profile at the turnarounds (referred to as a “turnaround effect”). As discussed below, none of the cited prior art references teaches or suggests the two or more rotational degrees of movement of the magnet arrangement about an axis or the advantages associated with this rotational movement.

The Masaki patent is directed to a magnetron sputtering device wherein a “magnet 4 is at the same time moved back and forth at a specified period in an arrow A direction by a horizontal moving mechanism 41 with respect to the target 3...” This back and forth movement of the magnet would not eliminate the turnaround effect because magnetic flux lines would always be at the position with respect to the ends of the target thus causing a steep erosion profile. Therefore, the Masaki patent does not teach or suggest the rotational

movement of the magnet arrangement about an axis or the new and unexpected results of a broad erosion profile of the target at the turnarounds.

The Nakazato patent is directed to a plasma processor comprising a processing chamber, means to reduce a pressure in the processing chamber, means to introduce a processing gas into the chamber, means to produce an electric field within the chamber, and means to establish a magnetic field orthogonal to the electric field, wherein a magnet element 60 is disposed so as to be rotatable within a plane orthogonal to an electric field (See Abstract, Fig. 1 and column 4, lines 12-14). The Nakazato only teaches one degree of rotational movement of the magnet arrangement about an axis. Therefore, the Nakazato patent does not teach or suggest the claimed invention.

The Bernick patent is directed to a magnetron sputtering electrode for use within a magnetron sputtering device having more uniform cooling of the target with the use of a water chamber including water diverters to establish a turbulent water flow within the water chamber. The Bernick patent does not teach or suggest rotational movement of the magnet arrangement as in the claimed invention.

The Suzuki patent discloses an offset magnet arrangement with respect to a circular support plate, which thereby creates an eccentric motion of the magnets. The Examiner concedes on page 10, second paragraph that the Suzuki patent does not teach a magnetron that is capable of more than one degree of movement. Therefore, the Suzuki patent does not teach or suggest the claimed invention.

The Ogawa patent discloses a magnet 7, which is a non-closed magnet arrangement, that does not rotate on its own axis, but instead orbits around a shaft 14. The orbital radius can be increased or decreased via a screw shaft 20 in a linear manner. The Examiner asserts that the magnetron of the Ogawa patent can be moved rotationally and linearly utilizing two motors (e.g., concentric and linear). Because of the linear (back and forth) motion, the magnetic flux lines will be at the same position with respect to the ends of the target. This linear and concentric movement of the magnet arrangement will not eliminate the turnaround effect, and therefore result in a steep profile at the turnarounds of the target. Therefore, the Ogawa patent does not teach or suggest a magnet arrangement having two or more rotational degrees of freedom of movement about an axis (e.g., concentric and eccentric) as in the claimed invention.

The Examiner cites the Fukami patent for the asserted teaching of the apexes of the magnetic poles being up to half the thickness of the magnet segment. The Fukami patent does not teach or suggest a magnet arrangement having two or more rotational degrees of freedom of movement about an axis as in the claimed invention.

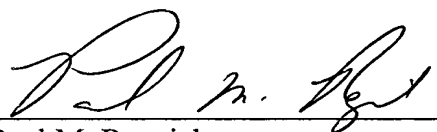
Because none of the cited prior art references teaches or suggests a magnet arrangement having the two or more rotational degrees of movement about an axis or the advantages associated with this rotational movement, the Applicant believes that the subject matter of amended independent claims 1, 13 and 15 and dependent claims 2, 3, 5-7, 9, 11, 12, 14, 17 and 18 is distinguishable over the cited prior art.

CONCLUSION

Based on the foregoing amendments and remarks, reconsideration of the rejections and allowance of pending claims 1-3, 5-7, 9, 11-15 and 17-18 are respectfully requested.

Respectfully submitted,

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